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Official Science on Saturday
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Student Notes

Science on Saturday

March 3, 2012

Restoring Sight to the Blind: Bridging the Medical Gap with Technology

Presenters:

Lawrence Livermore National Laboratory
- Satinderpall Pannu - Scientist
- Vanessa Tolosa - Chemical Engineer
- Angela C. Tooker – Electrical Engineer
- Kedar Shah - Mechanical Engineer
- Heeral Sheth – Biomedical Engineer
- Sarah Felix – Mechanical Engineer

Tracy High School, Tracy Unified School District
- Kirk Brown - Science Teacher

Program Summary:

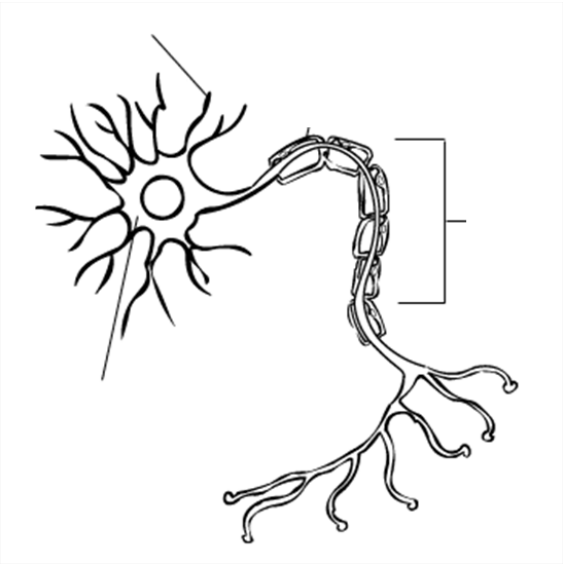
You will learn how the nervous system works and how neurons communicate. You will also learn the parts of an eye and how a human eye differs from a cow's eye. There are two major causes of vision loss that a retinal implant can cure. These two diseases and their symptoms will be discussed. In addition, technologies will be discussed that are being developed that can potentially restore sight to those whose vision has been impaired by these diseases.

Student Lecture Notes:

1. What is a neural prosthetic? Give one example from a science fiction movie.

2. What is an example of a technology that was once science fiction that is now a reality?

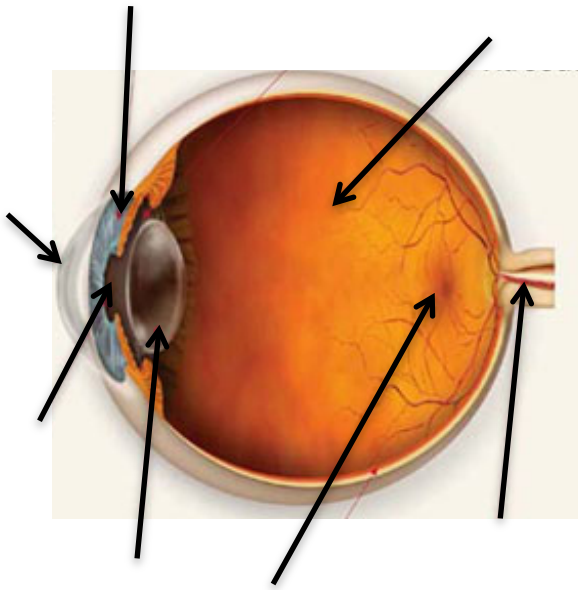
3. Label the parts of a neuron.



4. What do neuron dendrites and axons do?

5. Approximately how many neurons are in the human brain?

6. Label the diagram of an eye:



7. What structure does a cow's eye have that a human eye does not have that makes its eye reflective when a light is shined into it?

8. Which disease causes one to lose their central focal point of vision first?

9. Which disease causes one to have “tunnel vision?”

10. What are the three parts of a retinal implant?

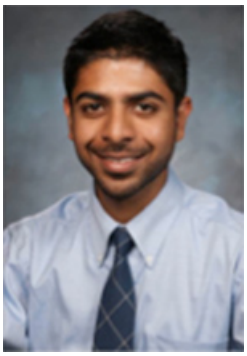
11. Would someone be able to see great detail with the retinal implant that is in clinical trials?

Speaker Bios:

Dr. Sat Pannu is currently the Section Leader for the Center for Micro- and Nano-Technology in the Engineering Directorate at Lawrence Livermore National Laboratory. He manages a group of scientists and engineers as well as a fabrication facility dedicated to the research of micro- and nano-technology. Dr. Pannu also leads his own research team developing biomedical devices such as the retinal prosthesis for the Department of Energy's Artificial Retina project. Dr. Pannu began his education at Yuba Community College and then transferred to University of California at Berkeley where he obtained his doctoral degree in Mechanical Engineering.

Dr. Vanessa Tolosa is a research engineer at the Center for Micro and Nano Technology at Lawrence Livermore National Lab. She received her B.S. degree in Chemical Engineering from the University of Florida and her Ph.D. from UCLA. Dr. Tolosa’s is interested in engineering device platforms (biosensors, neural interfaces, chemical sensors) for both biomedical and environmental applications.

Dr. Angela Tooker received her Ph.D. in Electrical Engineering from the California Institute of Technology in 2007. She has been doing research in a variety of biomedical/bioengineering fields for more than 11 years. For the past 9 years, she has been developing microfabricated devices, including BioMEMS devices (for both in vivo and in vitro experiments), micro-fluidic devices, and various mechanical sensors.



Kedar Shah is a Biomedical Microsystems Engineer at the Center for Micro- and Nano-Technology at Lawrence Livermore National Laboratory. He received his M.S. degree in Mechanical Engineering from The University of California at Berkeley, and a B.S. in Engineering Science and Mechanics from The Pennsylvania State University. His research interests include microsystem packaging and assembly, neural prosthetic devices, bio-compatible materials, and novel micro- and nano-fabrication technologies.

Dr. Sarah Felix received her Bachelors degree in Mechanical Engineering from Boston University. After working for several years in the aerospace and defense industry, she returned to graduate school and earned a Masters and Ph.D. in Mechanical Engineer from the University of California, Berkeley (2010). Upon completing her graduate studies, Dr. Felix joined Lawrence Livermore National Laboratory where she has worked in the areas of precision engineering, microfabrication and bioMEMS

Heeral Sheth is a research engineer at the Center for Micro and Nano Technology in the Engineering Technologies Division at Lawrence Livermore National Laboratory. She is focused on designing novel devices that interface with neural systems in the human body, as well as developing direct writing techniques to print 3D structures for neural systems and tissue engineering applications. Her current research involves the use of new materials and processes to develop nano-micro-meter scale structures that are designed to interact with biological systems and contribute towards advancements in fabrication technology and medical applications. She received a Bachelor of Science degree in Chemical Engineering and a Master of Science degree in Biomedical Engineering from the University of Michigan.